MAGNETIC SEALING APPARATUS FOR PORTAL COVERING

FIELD OF THE INVENTION

[0001] The present invention relates to the field of closures for windows, doors, or other portals and more particularly to closures which can be selectively positioned. In greater particularity the present invention relates to an apparatus for magnetically sealing a non-sliding roll-up closure for a portal.

BACKGROUND OF THE INVENTION

[0002] Various applications are known wherein a portal requires a closure, or cover, to prevent the passage of wind, rain, light, insects, or any other elements through the portal. As used herein, portal simply means an opening which would allow the passage of such elements therethrough; hence a portal may be a window and the closure of the instant invention may control the passage of any of the above elements therethrough. The present invention addresses the need for improved closures for portals such as may be found on patios, pool houses, green houses, warehouses, livestock houses, atriums or any other similar structures. The portal may be as small as would accommodate a ventilation fan in a gymnasium or livestock house, or as large as an atrium wall in a solar efficient building or an inclined roof panel. Additionally, the position of the portal can range from vertical to horizontal or any angle therebetween.

SUMMARY OF THE PRESENT INVENTION

[0003] It is the object of the present invention to provide a means for effectively covering portals such as windows and doors in a number of differing types of buildings.

[0004] Another object of the invention is to provide a reliable and easily operated closure for such portals.

[0005] These and other objects of the present invention are accomplished through the use of an improved roll-up closure. The closure utilizes a flexible cover or curtain selected from a material suitable to effect the type of closure sought. The cover is at least as wide as the portal to be covered and is typically longer than the portal. Each opposing longitudinal side of the cover preferably has a strip of hook and loop fastener material affixed thereto, and a complementary strip affixed to the lateral margins of the structure defining the portal. A first end of the cover is rigidly affixed across a first margin of the portal. The opposite end of the cover is preferably upturned and connected to a driven take-up roller mounted to the first margin of the portal, either directly or by cables or straps. In one embodiment, a first elongated rod is supported within the upturned end of the cover. In an alternate embodiment, a second elongated rod is included above the first elongated rod and separated therefrom by the cover. In either embodiment, activation of the driven roller lengthens or shortens the effective length of the cover while positioning the mating hook and loop fasteners to seal and unseal the cover to the lateral margins of the portal.

[0006] The present invention further comprises means for magnetically urging the opposing ends of a pocket created by the upturned ends of the cover toward the lateral margins of the structure defining the portal to maintain tension on the cover such that the cover forms an adequate seal with the lateral margins of the portal. In one embodiment, the present invention provides means for magnetically connecting opposing ends of the first rod to the lateral margins. In an alternate embodiment, the present invention provides means for magnetically connecting opposing ends of the second rod to the lateral margins. The magnetic sealing apparatus of the present invention biases the opposing ends of the first or second rod directly toward the lateral margin so as to effect a proper seal. In this manner, the present invention biases the opposing ends of a pocket created by the upturned ends of the cover toward the lateral margins at an angle substantially perpendicular thereto, thereby eliminating the reliance on a lateral component of the weight of the first or second rod or other biasing means for a portal covering known in the prior art.

[0007] These and other objects and advantages of the invention will become apparent from the following detailed description of the preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] A closure embodying features of the invention is described in the accompanying drawings which form a portion of this disclosure and wherein:

[0009] FIG. 1A is a perspective view of the invention in a partially raised position;

[0010] FIG. 1B is a perspective view of the magnet housing assembly of the embodiment of Figure 1A.

[0011] FIG. 2A is a perspective view of an alternate embodiment of the invention in a partially raised position;

[0012] FIG. 2B is an enlarged perspective view of the magnet housing assembly of the embodiment of Figure 2A.

[0013] FIG. 3 is a perspective view of another alternate embodiment of the invention in a partially raised position.

[0014] FIG. 4 is a rear perspective view of a magnet housing assembly of the present invention.

[0015] FIG. 5 is a front perspective view of a magnet housing assembly of the present invention.

[0016] FIG. 6 is a front elevational view of a magnet housing assembly of the present invention.

[0017] FIG. 7 is a perspective view of a magnet housing assembly of the present invention shown in a sectional view taken along line 7-7 of Figure 4.

[0018] FIG. 8 is a sectional view taken along line 8-8 of Figure 1A.

[0019] FIG. 9 is a left side elevational view of a magnet housing assembly of the present invention.

[0020] FIG. 10 is an exploded perspective view of a magnet housing assembly of the present invention.

[0021] FIG. 11 is a front perspective view of an alternate embodiment of the magnet housing assembly of the present invention.

[0022] FIG. 12 is a front perspective view of another alternate embodiment of the magnet housing assembly of the present invention.

[0023] FIG. 13 is a rear perspective view of another alternate embodiment of the magnet housing assembly of the present invention.

[0024] FIG 14 is a sectional view taken along line 14-14 of Figure 13.

[0025] FIG. 15 is a front elevational view of the magnet housing assembly of the embodiment of Figure 13.

[0026] FIG. 16 is an exploded perspective view of a track and another alternate embodiment of the magnet housing assembly of the present invention.

[0027] FIG. 17 is a top view of the track and magnet housing assembly of the embodiment of FIG. 16.

[0028] FIG. 18 is a sectional view taken along line 18-18 of Figure 16.

[0029] FIG. 19 is a front elevational view of the magnet housing assembly of the embodiment of FIG. 16.

[0030] FIG. 20 is a vertical sectional view of a magnet assembly of the embodiment of Figure 5 showing the standard magnet field of the magnet assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0031] The invention disclosed herein is technology related to U.S. Patent Nos. 5,566,736, 5,752,557, 5,785,105, 5,960,847, and 6,138,739, all of which are incorporated herein by reference. A more complete understanding of the invention may be obtained by reference to the accompanying drawings wherein the closure **10**, according to the preferred embodiment, covers a portal or opening **11** having a pair of lateral margins **13** and **14**. Lateral margins **13** and **14** extend the full vertical length of opening **11** and may terminate at a lower margin (not shown), which extends across the width of the opening. Across the top of opening **11** is an upper margin **12** which extends from margin **13** to margin **14**. Thus, it may be seen that the opening is completely framed by the aforementioned upper, lower, and lateral margins **12**, **13**, and **14**. It is to be understood that the present invention may be positioned vertically, horizontally, or inclined, thus the terms lower or upper margin do not imply only vertical disposition of the unit.

[0032] Attached to upper margin **12** is a first end **15a** of a curtain **15**, the curtain being comprised of a flexible material selected in accordance with the purposes of the present invention for its ability to block or transmit light, air, moisture, insects, or the like from one side to the other thereof. Therefore, curtain **15** is properly defined as a flexible barrier material, having a first end **15a** secured to upper margin **12** and opposing longitudinal sides **15c** and **15d**, which are longer than the length of lateral

margins **13** and **14**, and a lower end **15b**. Attached to lateral margins **13** and **14** and to sides **15c** and **15d** are complementary closure members **16** and **17**, such as hook and loop fastener material, which can be selectively attached and detached. Each of the opposing longitudinal sides **15c** and **15d** of the cover has a strip of hook and loop fastener material **17** affixed thereto, and a complementary strip **16** is affixed to the lateral margins **13** and **14** of the structure defining the portal **11**. Note that the closure members need only be approximately commensurate in length with the length of the margins, thus lower end **15b** of curtain **15** does not need the fastener material. A transverse closure (not shown) may be provided in conjunction with lower margin (not shown); however, on a door, a lower margin would not be present.

[0033] As illustrated in FIGS. 1A, 2A, and 3, lower end **15b** may be connected to a driven transverse take-up roller **18** mounted for rotation above the tops of margins **13** and **14**. The lower end **15b** may be directly connected to the driven roller **18** as shown in FIG. 1A, or, alternatively, by cables or straps **19** as shown in FIGS. 2A and 3. In any case, roller **18** is driven by a reversible motor **20** attached to a selected means of control (not shown), and supports end **15b**.

[0034] The present invention provides an apparatus **10** for opening and closing an opening or portal **11** having a first or upper end **12**, a second or lower end (not shown), and a pair of spaced apart opposing lateral margins **13** and **14** in a structure. The flexible curtain **15** of the present invention is at least as wide as the portal **11** to be covered and is typically longer than the portal **11**. The flexible curtain **15** has elongated side portions **15c** and **15d**, a first end **15a** and a second or lower end **15b**

each having a dimension commensurate with the separation of the lateral margins **13** and **14**. The first end **15a** is fixedly attached across the portal **11** at a first end or upper margin **12** thereof. The second end **15b** is folded back on itself, or upturned, to define a pocket opening toward the first end **15a**. The second end **15b** can be connected to a driven take-up roller **18** mounted to the first margin **12** of the portal, either directly as shown in FIG. 1A or by cables or straps **19** as shown in FIGS. 2A and 3A.

[0035] In one embodiment, a first elongated rod **21** is supported or captured within the pocket created by upturned end **15e** such that the first rod **21** is lifted within the pocket as roller **18** is rotated to wrap the upturned end **15e** or straps **19** thereabout and raise the curtain **15**. In an alternate embodiment, a second elongated rod **22** is included above the first elongated rod **21** and separated therefrom by the cover **15**. It will be appreciated that as driven roller **18** rotates, the first rod **21** and second rod **22** are constrained to rotate in opposite directions with the upturned end of flexible curtain **15** passing between them.

[0036] The present invention further comprises means for magnetically urging the pocket formed by the upturned ends of the cover **15** toward the lateral margins **13** and **14** to maintain tension on the cover **15** such that, as further described below, the cover **15** forms an adequate seal with the lateral margins **13** and **14** of the portal. In one embodiment, the present invention provides means for magnetically connecting opposing ends of the first rod **21** to the lateral margins **13** and **14**. In an alternate

embodiment, the present invention provides means for magnetically connecting opposing ends of the second rod **22** to lateral margins **13** and **14**.

[0037] Carrying closure **17** of the curtain sides **15c** and **15d** is pressed against complementary closure **16** of the lateral margins **13** and **14** as the first rod **21** is lowered, thereby ensuring a sealing connection as a result of the first rod **21** or second rod **22** being magnetically urged toward the lateral margins **13** and **14**. The magnetic sealing apparatus of the present invention provides a biasing force for urging the opposing ends of the first rod **21** or second rod **22** toward the lateral margins **13** and **14** at an angle substantially perpendicular thereto so as to effect a proper seal. As driven roller **18** raises the curtain **15**, the lifting force is transferred around the first rod **21** to provide an opening force to the closures **16** and **17** substantially perpendicular thereto, such that they are readily detached.

[0038] From the foregoing, it can be appreciated that the present invention comprises means operatively connected to the second end **15b** of the curtain for varying the height of the pocket. It is easily seen that as driven roller **18** rotates, it effectively varies the length of curtain **15** such that the first rod **21** and second rod **22**, if present, urge closure members **16** and **17** into and out of sealing engagement. It is also contemplated that the lower end **15b** of the curtain be fixedly attached to the first rod **21**. In this embodiment (not shown), at least one cord encircles the first rod **21** and is attached at one end to driven roller **18** and at a second end to a point above the maximum height of the first rod **21** when fully raised. As driven roller **18** rotates, cords are wound around the driven roller **18**, effectively shortening the length of

cords. As a result, the first rod **21** is rotatably raised and the lower end of curtain **15** is wound around the first rod **21**. In each of the above-referenced embodiments, activation of the driven roller **18** lengthens or shortens the effective length of the cover **15** while positioning the mating hook and loop fasteners **16** and **17** to seal and unseal the cover **15** to the lateral margins **13** and **14** of the portal.

[0039] The present invention provides means for magnetically urging the pocket formed by the upturned end of the curtain **15** toward the lateral margins **13** and **14**. In the preferred embodiment shown on FIGS. 1A and 1B, each lateral margin **13** and **14** has a magnetically attractable support surface **23** integral therewith. It is also contemplated that in other embodiments, the magnetically attractable support surface may be affixed to the lateral margins **13** and **14**, such as but not limited to being in the form of a metal or magnetic strip **35** commensurate with the vertical length of the lateral margins **13** and **14**. In the preferred embodiment, means for magnetically urging comprises at least one magnet **24** operatively connected to each opposing end of the second rod **22**. More specifically, in the preferred embodiment each at least one magnet **24** is rotatably mounted to each opposing end of the second rod **22**.

[0040] The preferred embodiment comprises a magnet housing assembly **26** to which the at least one magnet **24** is connected. The magnet housing assembly **26** is itself rotatably mounted to each opposing end of the second rod **22** so that the second rod **22** may freely rotate as the curtain **15** is raised and lowered. The magnet housing assembly **26** and at least one magnet **24** may be of any

configuration that allows the opposing ends of the second rod **22** to remain magnetically connected to the lateral margins **13** and **14** as the curtain **15** is raised and lowered. Thus, the at least one magnet **24** of the present invention is operatively connected to each opposing end of the second rod **22** rod with the at least one magnet **24** providing discrete areas that contain sufficient magnetic flux density to retain each end of the second rod **22** to the magnetically attractable surface **23** of the lateral margins **13** and **14**. As further discussed below, the various configurations of magnet housing assemblies **26** and magnets **24** may alternatively be operatively connected to opposing ends of the first rod **21**.

[0041] As shown in FIGS. 4-10, the preferred embodiment comprises a plurality of cylindrical magnets **24**, each having a central bore **24a** mounted in axial alignment for rotation about a mounting rod **27** passing therethrough. More specifically, the preferred embodiment comprises a first pair **29a** of cylindrical magnets **24** having a central bore **24a** mounted in axial alignment for rotation about a first mounting rod passing therethrough; and a second pair **29b** of cylindrical magnets **24** having a central bore **24a** mounted in axial alignment about a second mounting rod passing therethrough. As shown in FIGS. 1A and 6, the cylindrical magnets **24** are mounted for rotation about a longitudinal axis positioned generally parallel to the longitudinal axis of the second rod **22**, traverse to the lateral margins **13** and **14**. In this manner, the second rod **22** and magnet housing assembly **26** can travel vertically as driven roller **18** is rotated to raise and lower the curtain **15**.

[0042] The present invention further comprises at least one cylindrical spacer member **28** interposed between two adjacent cylindrical magnets **24**. With reference to FIG. 10, the preferred embodiment has two spacer members **28** in the general shape of conventional metallic washers interposed between adjacent cylindrical magnets **24** and at each end thereof. Each pair **29a** and **29b** of cylindrical magnets **24** is mounted within one of two cylindrically shaped openings formed in the magnet housing assembly **26**. One end of each mounting rod **27** at least partially passes through a slot **30** formed in a side of the housing assembly **26** at one end of the cylindrically shaped opening. This end of the mounting rod **27** is held in place and prevented from lateral movement by a roll pin **32** passing through an opening formed in the mounting rod **27**.

[0043] The other end of each mounting rod **27** at least partially passes through a slot **30** formed in a bushing or retaining member **31** that is held in place by a set screw **33**. Interposed between the roll pin **32** and retaining member **31** are a plurality of cylindrical spacer members **28** and cylindrical magnets **24** having a central bore through which the mounting rod **27** passes. It can be appreciated that this mounting arrangement allows for rotation of the magnets **24** and spacer members **28** about the mounting rod **27**.

[0044] As shown most clearly on FIGS. 7 and 9, the cylindrical magnets **24** and spacer members **28** are mounted in a partially recessed position within the housing assembly **26**, so that at least a portion of the magnets **24** and spacers **28** extends beyond the forward surface **26a** of the housing assembly. This allows a portion of

the magnets **24** and spacers **28** to be in contacting engagement with the magnetically attractable support surface **23** of the lateral margins **13** and **14**. With reference to FIGS. 4 and 9, the slots **30** formed in the side of the housing assembly and retaining member **31** are generally horizontally disposed. This allows lateral movement of the mounting rods **27** to a limited extent generally perpendicular to the lateral margins **13** and **14** during use. This facilitates maintaining the magnetic connection of the magnet housing assembly **26** with the lateral margins **13** and **14** in situations where there are irregularities in the surface of the lateral margins **13** and **14** such as warping. It may be appreciated that during use, the slots **30** allow each respective mounting rod **27** to move independently to a limited extent normal to the surface of the lateral margin **13** and **14** to maintain a magnetic connection.

[0045] Although the preferred embodiment provides a magnet housing assembly making contacting engagement between the at least one magnet **24** and the lateral margins **13** and **14**, such contacting engagement is not required. It is contemplated, by way of example without limiting the scope of the disclosure herein, that a magnet may be completely disposed within the magnet housing assembly so that only the housing assembly **26** makes contacting engagement with the lateral margin **13** and **14**. Alternatively, the spacer members **28** may have a larger diameter than the magnets **24** so that only the spacer members **28** actually contact the magnetically attractable support surface **23** of the lateral margins **13** and **14**.

[0046] The manner in which the magnet housing assembly **26** of the present invention operates is shown in FIGS. 1B and 8. As can be seen in FIG. 1B, curtain

sides **15c** and **15d** and carrying closure **17** are pressed against complementary closure **16** of the margin as the first rod **21** is lowered, thereby ensuring a sealing connection as a result of the second rod **22** being magnetically urged toward the magnetically attractable support surface **23** of the lateral margins **13** and **14**. The magnetic sealing apparatus of the present invention provides a biasing force for urging the opposing ends of the second rod **22** toward the lateral margin **13** and **14** at an angle substantially perpendicular thereto so as to effect a proper seal. With reference to FIG. 8, the curtain **15** passes downward from its upper end **15a** along the lateral margins **13** and **14** between the second elongated rod **22** and the lateral margin **13** and **14**, to a point where it is upturned to form a pocket that captures the first elongated rod **21**. The first elongated rod **21** is not operably connected to the magnet housing assembly **26**, but instead is allowed to rotatably "float" within the pocket as the curtain **15** is raised and lowered.

[0047] The upturned end of the curtain **15** passes upward around the first elongated rod **21** and then between the second elongated rod **22** and the lateral margins **13** and **14** so that both a downward and upward portion of the curtain **15** are disposed between the second elongated roller **22** and the lateral margins **13** and **14**. Because a strip of hook and loop fastener material **17** is affixed to only one surface of the curtain **15** along each longitudinal side **15c** and **15d** thereof, the hook and loop fastener material **17** does not engage either the surface of the first elongated roller **21** or itself as the curtain **15** is raised and lowered.

[0048] The magnet housing assembly **26** further comprises an elongated retaining rod **34** extending from the housing assembly **26** between the downward and upward portions of the curtain **15**, as shown in FIGS. 1B and 8. The retaining rod **34** is positioned above the second elongated rod **22** so that if the housing assembly **26** becomes detached from the lateral margins **13** and **14**, the pocket formed by the upturned end **15b** of the curtain will catch the rod **34**. This retains the magnet housing assembly **26** and second elongated rod **22** therein to prevent the assembly **26** and rod **22** from falling. In this event, the retaining rod **34** allows the housing assembly **26** to be readily remounted magnetically to the lateral margins **13** and **14**. In the preferred embodiment, the magnet housing assembly **26** also has an inclined upper surface **26b** that prevents debris from accumulating thereon and facilitates cleaning of the assembly **26**.

[0049] The magnet of the present invention may be a permanent magnet or electromagnet, preferably a permanent magnet. Types of permanent magnets include ferrite (both bonded and sintered), rare earth, cunife, Alnico (Aluminum-Nickel-Cobalt), ceramic, samarian cobalt, and neodymium iron boron. The magnet is preferably of the rare earth type, because such magnets have the highest available energy-per-unit volume and weight as well as the highest available resistance to demagnetization. Rare earth magnets also have excellent temperature stability and can be machined to be very thin.

[0050] The preferred embodiment provides two pairs of magnet assemblies, as shown in FIG. 5, wherein each magnet assembly comprises two cylindrical magnets

24 disposed in stacked relationship with respect to one another. Paired spacers **28** are positioned between adjacent magnets **24** and at ends thereof. As shown in FIG. 20, the magnets **24** are oriented with like magnetic poles abutting across intervening spacers **28**. Because the individual magnetic segments are poled and positioned in this configuration, with adjacent magnets **24** stacked such that each magnet repels an adjacent magnet **24**, a substantial fringing flux is created at the sides of the spacers **28** providing a strong magnetic attraction orthogonal to the longitudinal axis of the mounting rod **27**. Although the preferred embodiment utilizes two pairs of cylindrical magnets **24**, it is contemplated that alternate magnet shapes and configurations may be utilized with the present invention. For instance, the invention may utilize a single cylindrical magnet **24** rotatably mounted to each end of the second rod **22**, as shown in FIG. 11, or a pair of cylindrical magnets **24** as shown in FIGS. 12 and 13-15. Other magnet shapes may also be used, such as bars and disks.

[0051] Similarly, the configuration of the housing assembly **26** can vary, as shown by way of example by comparing the housing assembly provided in FIG. 12 with the housing assembly provided in FIGS. 13-15. It can be appreciated that while both of these assemblies provide magnets **24** in the form of a single pair of cylindrical magnets **24**, the respective magnets **24** and housing assemblies **26** have different configurations. In comparison to the embodiment of FIG. 12, the magnet housing assembly provided in FIGS. 13-15 has cylindrical magnets **24** having a shorter width as measured along a line parallel to the longitudinal axis of the mounting rod **27** and designated by the letter **W** in FIG. 15. For this reason, this alternate embodiment

may be utlized with a narrower magnetically attractable support surface **23**. Unlike the embodiment shown in FIG. 12, this alternate embodiment also has single spacer members **28** at the ends of the magnets **24**. Additionally, the alternate embodiment of FIGS. 13-15 has spacer members **28** with larger diameters than the cylindrical magnets **24**, as shown most clearly in FIG. 15. This provides for contacting engagement between the outer edge of the spacer members **28** and the lateral margins **13** and **14** without contacting engagement between the magnets **24** and the lateral margins **13** and **14**.

[0052] An alternate configuration of the housing assembly **26** of the present invention is provided in FIGS. 16-19. This embodiment has a U-shaped housing member **26d** similar to that provided in the embodiment in FIGS. 13-15. But instead of providing a pair of cylindrical magnets **24**, the embodiment in FIGS. 16-19 provides a pair of rectangular magnets **24** mounted in side-by-side relationship within a channel formed by the U-shaped housing member **26d**. The magnets **24** are interposed between a pair of nonmagnetic rollers **40** mounted within the U-shaped housing member **26d** on mounting rods **27**. In this alternate embodiment, the nonmagnetic rollers **40** are positioned to allow for contacting engagement with the lateral margins **13** and **14** without contacting engagement between the magnets **24** and the lateral margins **13** and **14**, as is most clearly shown in FIG. 18.

[0053] Preferably, the housing portions of the magnet housing assemblies are configured to provide shielding of the magnetic force, so that the magnetic flux is primarily directed from the forward face **26a** of the housing assembly **26**

perpendicular thereto. This allows the magnet housing assembly **26** to provide discrete areas that contain sufficient magnetic flux density directed to the lateral margins **13** and **14**, while minimizing the magnetic flux density emanating from the magnet housing assembly **26** in other directions. In the alternate embodiments shown in FIGS. 13-15 and FIGS. 16-19, the housing portion of the magnet housing assembly **26** is comprised of a longitudinal U-shaped housing member **26d**, preferably of a magnetically attractable metal. In the embodiment shown in FIGS. 13-15, the housing assembly further comprises transverse structural members **26e**, preferably of a nonmagnetic plastic, mounted within the channel formed by the U-shaped housing member **26d**. In this embodiment, as shown in FIG. 14, the two cylindrical magnets **24** are each rotatably mounted within the aforementioned channel between adjacent transverse structural members **26e**. Both of the embodiments shown in FIGS. 13-15 and FIGS. 16-19 have U-shaped housing members **26d** with rounded upper corners **26f** along opposing upper edges of the housing portion rear surface, as shown most clearly in FIGS. 13 and 17. This configuration significantly enhances the shielding of the magnetic force.

[0054] An alternate embodiment of the present invention is provided in FIGS. 2A and 2B. This embodiment does not include a second elongated rod **22**, and provides at least one magnet **24** that is operatively mounted within the first elongated rod **21**. More specifically, with reference to FIG. 2B, in this embodiment a magnet **24** is internally disposed within each first elongated rod **21** at opposing ends thereof. The magnet assembly **26** is rotatably mounted so that as the first rod **21** is raised and lowered along the lateral margins **13** and **14**, the magnet **24** internally disposed

therein will remain in proper magnetic alignment with the magnetically attractable support surface **23** to maintain magnetic connection therewith.

[0055] An additional alternate embodiment is provided in FIG. 3. Similar to the embodiment shown in FIGS. 2A and 2B, this embodiment does not include a second elongated rod **22**. The embodiment of FIG. 3 provides a means for magnetically urging comprising at least one magnetic strip **35** affixed to each said lateral margins **13** and **14**. In this embodiment, the opposing ends of the second rod **22** have a magnetically attractable surface **23** integral therewith or affixed thereto.

[0056] It may be appreciated that the various embodiments of the means for magnetically urging may be utilized in the same manner to either urge the second rod **22** toward the lateral margins **13** and **14**, when a second rod **22** is utilized, or to urge the first rod **21** toward the lateral margins **13** and **14** when a second rod is not utilized. Thus, for example, the various forms of the aforementioned means for magnetically urging can comprise at least one magnet **24** operatively connected to each opposing end of the first rod **21** when a second rod **22** is not utilized. Each of the embodiments may be used alternatively either to magnetically connect the opposing ends of the first rod **21** to the lateral margins **13** and **14** or to magnetically connect the opposing end of the second rod **22** to the lateral margins **13** and **14** without departing from the scope of invention herein disclosed.

[0057] The present invention may be utilized with means for guiding opposing ends of the first or second rod along a path generally parallel to the plane of the lateral margins **13** and **14**. In the preferred embodiment, means for guiding

comprises a vertical lip **36** positioned along the outer edge of the lateral margins **13** and **14**, as shown in FIG. 1B. The lip **36** extends from the lateral margins **13** and **14** to a position extending forward thereof. In the preferred embodiment, the lip **36** is positioned orthogonal to the support surface of the lateral margins **13** and **14**. The lip **36** acts a vertical guide for the outer side surface **26c** of the magnet housing assembly as the curtain **15** is raised and lowered. The lip **36** allows either the first **21** or second **22** rod to travel vertically as pipe **18** is rotated, without pivoting in the horizontal plane about its respective mid point or moving significantly along its respective axis.

[0058] In the embodiment of the present invention provided in FIGS. 16-19, an alternate means for guiding comprises an elongated, generally U-shaped track **38** having a magnetically attractable support surface bounded by opposing vertical lips **36** extending therefrom. In this embodiment, the opposing lips **36** are positioned orthogonal to the magnetically attractable support surface, which may be considered integral with the lateral margins **13** and **14**. As shown in FIG. 16, and most clearly in FIG. 17, the housing assembly **26** is disposed within a channel formed by the track **38**. The opposing lips **36** of the track **38** act as vertical guides for the outer side surfaces of the magnet housing assembly **26** as the curtain **15** is raised and lowered. The tracks **38** and opposing lip portions **36** thereof allow the first **21** or second **22** rod to travel vertically as pipe **18** is rotated. This embodiment also provides means for pivotally attaching the end of the first **21** or second **22** rod to the magnet housing assembly **26**, in the form of a clevis assembly **42**. The clevis assembly **42** has a clevis pin **44** extending from an outer surface of the housing assembly **26**, and a

clevis keeper **46** adapted for receiving the clevis pin **44**. The clevis keeper **46** is rotatably mounted to the end of the first **21** or second **22** rod, which allows pivotal movement of the opposing housing assemblies **26** about the first **21** or second **22** rod as the curtain **15** is raised and lowered.

[0059] The means for guiding may also comprise opposing channel members having alternate configurations for capturing the opposing ends of the first rod **21** and, if present, the second rod **22**. The opposing channel members (not shown) may have the magnetically attractable support surface **23** of the lateral margins **13** and **14** formed integral therewith or otherwise affixed thereto. However, the use of means for guiding such as a lip **36**, a track **38**, or channel member is optional. The present invention provides means for biasing the pocket formed by the upturned ends of the cover **15** toward the lateral margins **13** and **14**, and perpendicular thereto. Thus, the present invention eliminates the reliance on means for guiding as well as reliance on a lateral component of the weight of the first rod **21** or second rod **22** or other lateral biasing means for a portal **11** covering known in the prior art.

[0060] The control mechanism may be any of a number of mechanisms depending on the needs of the application of the invention. For example, in a livestock confinement house or warehouse where temperature control is a necessity, the present invention may be used as a cover for a ventilation fan, and as a variable height curtain over a window. In this situation a temperature controller may be attached to each motor for each curtain and constantly monitor the temperature in the house. In this manner, the fans may be uncovered and actuated, and the curtain

raised or lowered to meet specific airflow conditions. In another example, the present invention may be used in a greenhouse, having a need to control the amount of sunlight on certain plants during particular months. In this situation, the motor may be controlled by a timer or may be connected to a sensing system connected to a plurality of photocells that incrementally indicate to the motor how much of the curtain should be raised or lowered. Likewise, the opening can be monitored to close during a rain shower. In the simplest case a switch to turn the motor on and off may be provided. Furthermore, limit switches of various kinds may be placed at various locations to further control the movement of the curtain, such that it may eliminate air curtains or the like.

[0061] It is ostensibly noteworthy to mention that the present invention is not limited to vertical portals, but can be used with portals ranging from vertical to horizontal or any angle therebetween. Additionally, the present invention is not susceptible to sliding friction between the parts because all of the mating surfaces are contacting each other in a rolling relationship. Therefore, wear on the curtain is minimized, and the drive units do not have to overcome friction to position the curtain. Furthermore, the curtain is not susceptible to jamming due to debris being wedged into sliding engagement with a component since no sliding movement is provided.

[0062] It is to be understood that the form of the invention shown is a preferred embodiment thereof and that various changes and modifications may be made therein without departing from the spirit of the invention or scope as defined in the following claims.